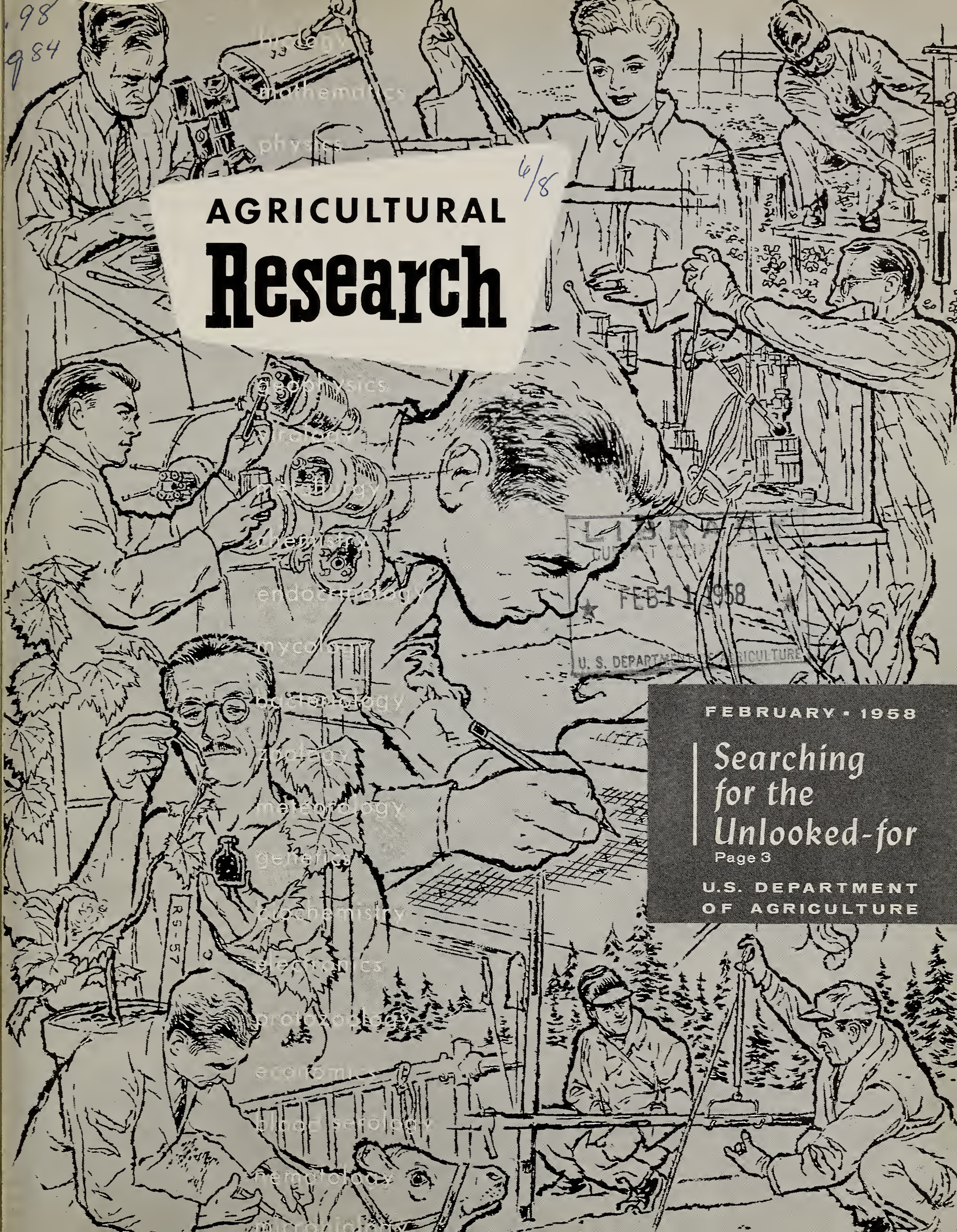
AGRICULTURAL Research



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U.S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 6—February 1958—No. 8

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Confidence

It has been estimated that the United States is spending more than $5 billion a year for research. This is more in 1 year than in all the years from 1776 to 1933.

A large part of this money is going into Government research for defense. But financial support of agricultural research has increased tremendously, too (see p. 3).

This reflects a growing realization of the contributions that research can make to a better agriculture.

There has been a great change in the attitude of those who use our results. Remember the old days, when many farmers weren't especially interested in research recommendations?

One scientist recently recalled when Kanred wheat was released by the Kansas Agricultural Experiment Station in 1917. Kanred had been tested for several years, both at the Station and on cooperating farms. It was a good variety—superior in many ways to Turkey, the variety then being grown in that area. The people at the Station really beat the drums for Kanred, but Kansas farmers were not willing to give up a familiar variety for one they didn't know much about.

Today, farmers are eager to try superior new varieties. The grower looks impatiently over the researcher's shoulder. A new wheat, soybean, or alfalfa is hardly out of the experimental plot before there is a clamor for seed.

Furthermore, today's farmer generally knows what he wants. In most cases, he has helped draw up the specifications—high yield; resistance to disease, insects, drought; harvest dates that fit in with those of other crops; ease of handling with machines; specific qualities desired by consumers.

This ready acceptance of new varieties, new materials, new equipment, and new practices makes it more important than ever that we know what we are talking about.

One way to help us avoid mistakes is to keep up with the demand—know what farmers want and need. And the best way to do this is to work together closely with our colleagues—Federal, State, and industrial—all along the line.

We must have such cooperation to make our results show that the confidence in researchers is fully justified.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Searching for the Unlooked-for

That's the job of scientists doing basic research. Their quest for new knowledge—a tradition in USDA—has been getting increased attention in recent years

Basic research is a systematic, intensive search directed toward increase of knowledge in science. It discovers the order in the universe and accounts for the happenings in our everyday environment. It establishes new laws and concepts that are often put to practical use by applied research. It dispels ignorance—and creates more ignorance.

Progress in applied research and development depends heavily on the growth and encouragement of basic research; without it, technological advance would be slowed down to a snail's pace.

The concepts, objectives, and methods of basic research are common to all science and all nationalities. Its results have universal application. Advances brought about as a result of such research in a particular area lead to totally unexpected developments in a wide range of unrelated sciences.

CREATIVE, pioneering studies that give us new scientific laws and principles have always had a place—but not always the same emphasis—in USDA research. Emphasis on basic research is currently increasing, with more money and effort backing it up now than ever before. Basic research comprises 17 percent of USDA's total research effort at present, and the figure is currently on the increase.

Such research—in widely varied sciences—has already given us tremendous insight into fundamental processes and helped change our way of life.

But there's still a great deal that we need to know—things like the mysteries of chlorophyll formation; the light-sensitive trigger mechanism that regulates flowering, seed setting, and germination; the forms of radiation that profoundly affect life; the complex series of events that make a hen lay an egg.

What the implications of basic discoveries like these may be are limited only by man's imagination. Unraveling these mysteries may give us entirely new approaches to our practical problems, such as feeding a population of 300 million people (expected by the year 2000) a nutritious diet resulting in greater vigor, stature, and life span. Elimination of harmful insects and plant and animal diseases could go a long way to reduce human disease. Shedding more light on synthesis of amino acids—life's main building blocks—might enable us to reproduce chemically some form of life. Bringing about mutations of living organisms by radiation or chemical means may permit scientists to regulate heredity.

Actually, we don't even know what such work can give us because we can't accurately visualize what the future holds. Who would have dreamed 50 years ago of today's fantastic achievements, such as harnessing atomic power? A research breakthrough in agriculture might have the same kind of effect.

Basic work important in early research

Scientific research has been one of USDA's main functions since its inception in 1862. Much early research developed to meet emergencies. But basic research played an important role, too. It was often necessary to perform fundamental work before solving many practical problems of the day. This led to some great contributions.

TURN PAGE

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The close of the 19th century, for example, found USDA scientists working on tick fever, then taking a dreadful toll of cattle. It wasn't long before researchers pinpointed protozoa-laden ticks as the carriers. Of course, this discovery got rid of tick fever. But it did something even more important. In showing that protozoa could carry disease, it laid the foundation for the new science of protozoology and opened the way for many of today's activities in the fields of public health and preventive medicine.

Federal laws promote fundamental studies

Basic research continued to gain because of a growing need for fundamental knowledge to provide a base for finding answers to more complex practical problems. This need was reflected in the passage of Federal laws providing for basic research. Among them was the Bankhead-Jones Act of 1935, which established nine regional laboratories (see map). The act also expanded support for research in State agricultural experiment stations.

Surprisingly, basic research slowly declined after passage of the Bankhead-Jones Act, reaching a low ebb in 1947. It's not hard to see why. Funds under this act—as well as other research funds—weren't increased to keep pace with decreasing dollar value. In addition, emphasis during the war years was on *applying* all background knowledge on hand. Nevertheless, much significant work emerged. We now have a better understanding of such matters as the nature of clays, the biology of insects, and the effects that light has on the growth of plants.

New pioneering scientists follow own leads

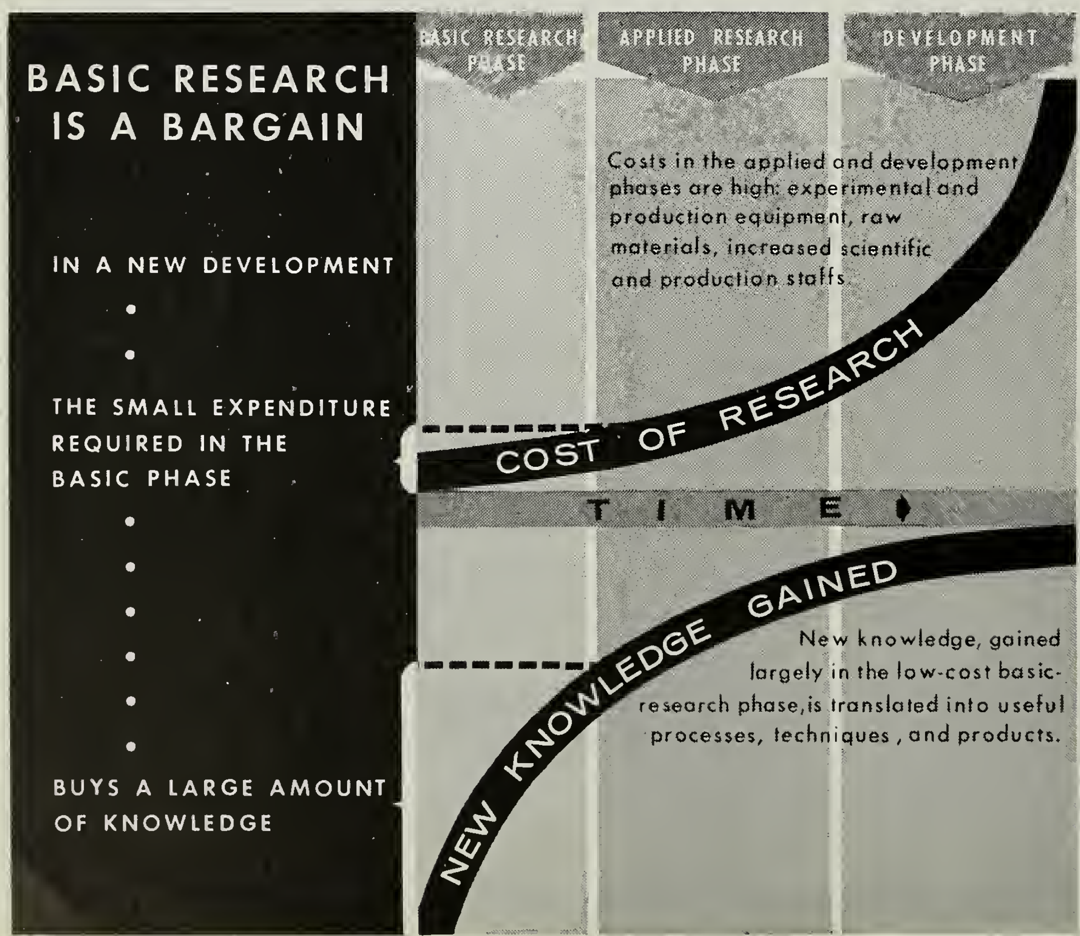
A great step forward in basic studies is the formation of pioneering research laboratories presently moving forward in ARS. These are being organized around outstanding scientists who have demonstrated a capacity for creative research. The scientists are developing their own research programs—following leads they think important. They have been relieved of administrative duties to devote all their time to basic studies.

Plans for these laboratories began to take shape in February 1957. Already set up are Pioneering Research Laboratories for Mineral Nutrition of Plants, Plant Physiology, Blood Antigens, Insect Pathology, Insect Physiology, Seed Protein, Plant Fibers, and Microbiological Chemistry. Other laboratories are being planned.

Pioneering researchers hope to provide answers to some of agriculture's most puzzling questions. Example: How can an inorganic ion move from a dilute solution in the soil into a much more concentrated plant sap? By all known laws, the movement should be the other way.

The recent steady growth of basic research in USDA probably can best be shown by comparing research expenditures for fiscal years 1947 and 1957.

Research funds used by USDA in 1947 totaled $33 million. A little more than $2 million, or 6 percent, went



BASIC RESEARCH

★ **USDA AGRICULTURE RESEARCH CENTER, BELTSVILLE, MD.**

USDA carries on research at almost 600 fiel locations throughout the Nation and its te ritories, including work at Federal field st tions and laboratories, and at State exper ment stations where USDA does cooperati work. Important basic research is performe at many of the 600 field locations.

● **53 AGRICULTURAL EXPERIMENT STATIONS**

Includes 2 each in New York and Connectic and 1 each in Alaska, Hawaii, Puerto Ric State experiment stations conduct research about 500 locations, including main station outlying laboratories, and farms.

into basic research. In 1957, USDA was spending nearly $73 million for research, with over $12 million or 17 percent going into basic research. Largest share of the research appropriation went to ARS—major research agency of USDA. ARS received over $54 million; over $11 million or 21 percent went into basic research.

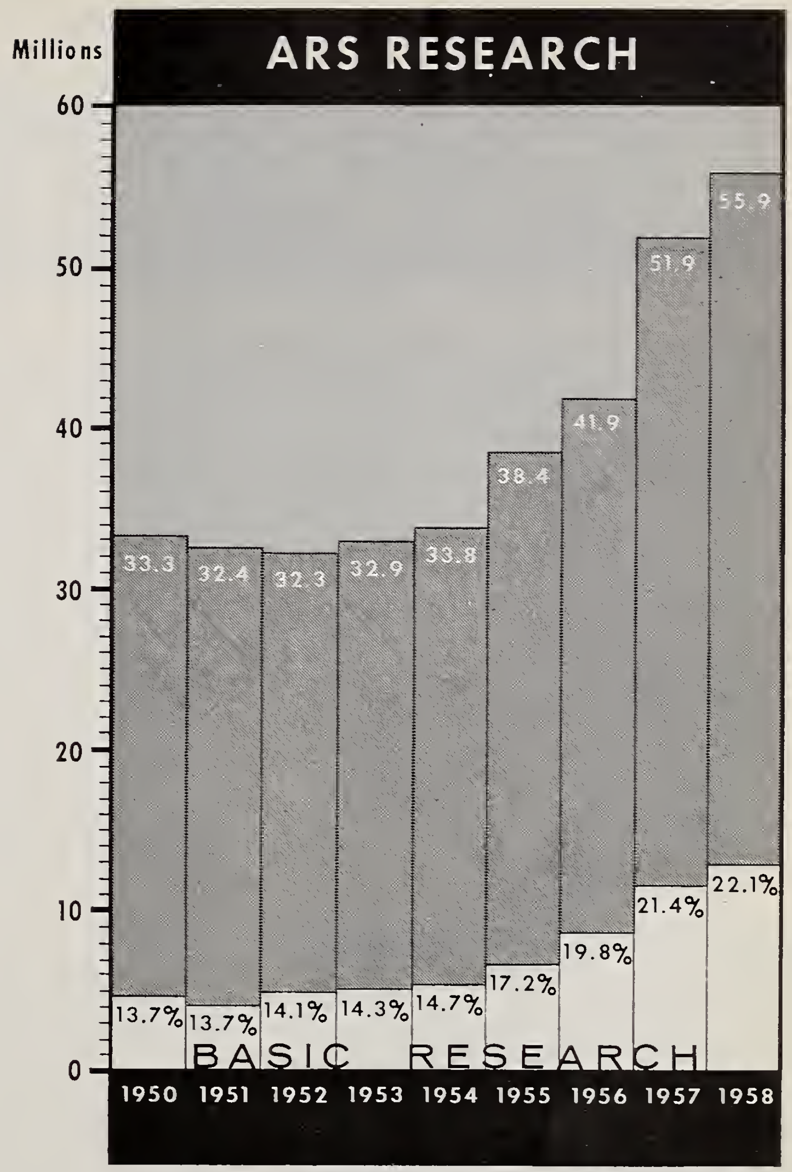
Other USDA agencies doing basic research are the Agricultural Marketing Service and Forest Service.

Research by the State agricultural experiment stations has contributed enormously to the Nation's agricultural economy. An estimate made in 1954 indicated that approximately 23 percent of the State experiment station research funds were devoted to basic research. Research authorizations for these stations for fiscal year 1958 total $120 million—$90 million of this amount supplied by the States, $30 million coming from Federal grants.

Along with this growth in basic research has come a great increase in the complexity of agricultural science. Today, such fields as animal husbandry, agronomy, and horticulture include researchers in a wide variety of disciplines from atomic science to zoology (see cover).

Low fund of knowledge prompts added effort

Applied research has drawn heavily upon scientific laws and principles established by past basic work. Our present fund of such basic knowledge is low. All signs point to rapidly increasing emphasis on science. Growing recognition of the value of basic research in our economy is again making us a Nation of pioneers. ☆



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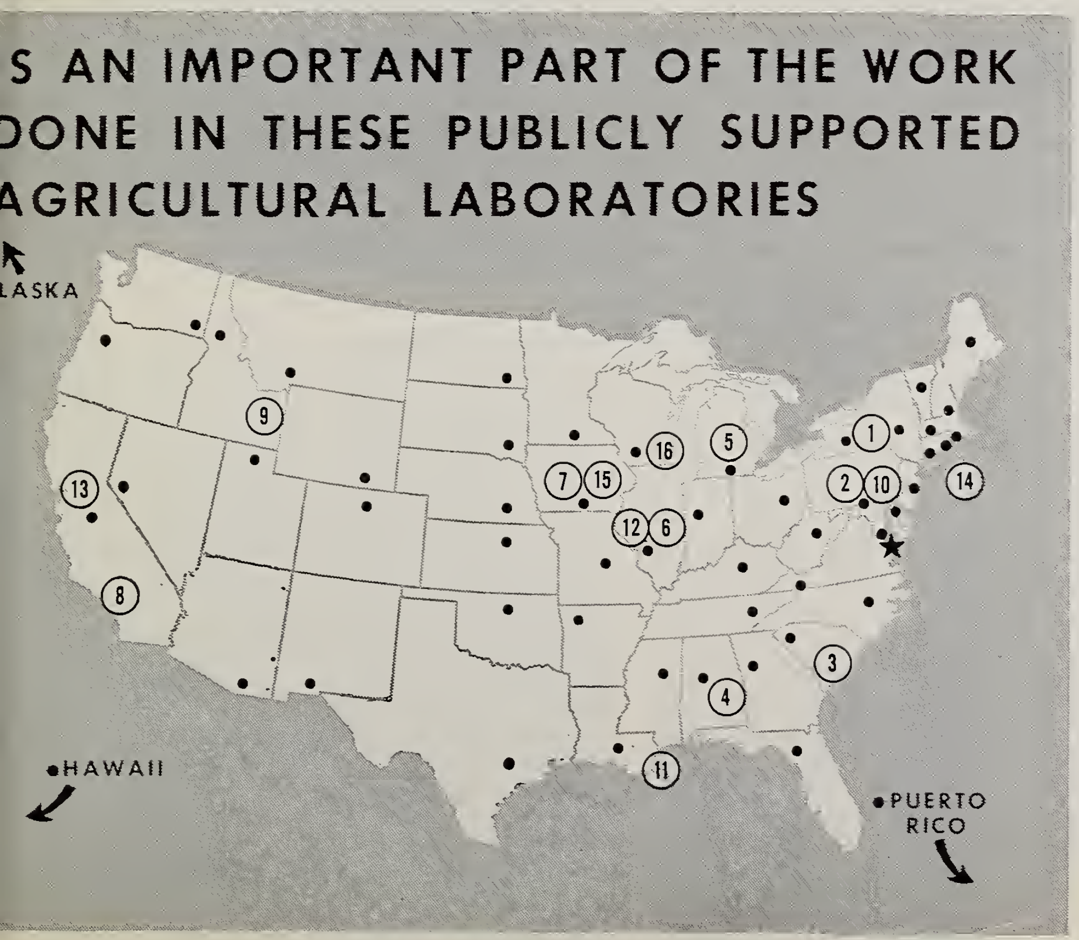


USDA REGIONAL RESEARCH LABORATORIES CREATED BY BANKHEAD-JONES ACT OF 1935

1. Plant, Soil, and Nutrition Lab., Ithaca, N. Y.
2. Pasture Research Lab., State College, Pa.
3. Vegetable Breeding Lab., Charleston, S. C.
4. Animal Disease Lab., Auburn, Ala.
5. Poultry Research Lab., East Lansing, Mich.
6. Soybean Lab., Urbana, Ill.
7. Swine Breeding Lab., Ames, Iowa
8. Salinity Lab., Riverside, Calif.
9. Sheep Breeding Lab., Dubois, Idaho

SOME OTHER MAJOR USDA LABORATORIES

10. Eastern Utilization Research Lab., Philadelphia
11. Southern Utilization Research Lab., New Orleans
12. Northern Utilization Research Lab., Peoria, Ill.
13. Western Utilization Research Lab., Albany, Calif.
14. Plum Island Animal Dis. Lab., Greenport, N. Y.
15. Animal Disease Lab., Ames, Iowa (plans approved)
16. Forest Products Lab., Madison, Wis.

THERE SHOULD BE SOMETHING OF VALUE IN THESE . . .

AFRICAN GRASSES

■ PLANT RELATIVES are often used effectively in breeding better characters into our crops. Typical of many groups of introductions are the 50 African grasses (variously related to the South's Bermudas) that are now being studied at Tifton, Ga.

These grasses, brought from Africa by USDA in 1955, belong to three species: *Cynodon dactylon* (our common Bermuda species), *C. transvaalensis*, and *C. plectostachyum*.

ARS forage agronomist J. L. Stephens gathered 500 plant introductions in the great continent over a 2,500-mile stretch of eastern plains and inland valleys from the Union of South Africa northward to Ethiopia. In the cooperative study by the Georgia Agricultural Experiment Station and USDA, the plants show a great range in vigor, leafiness, spread, and other plant characters in various combinations. It's a good guess that this collection will make a contribution to the South's grassland economy, either directly or through hybridization with existing materials. However, thorough testing under clipping and grazing will be required to determine what their potential value is.

Grasses from many areas

Ethiopia's two range types were collected. A tremendous grower with medium-fine stems was found in the Rift Valley, probable birthplace of the Bermudas. It has been grazed there for 3,000 years with 20 inches of rainfall. An even ranker, more aggressive strain came from Central Ethiopia. Stolons of it set out April 1 had covered the ground with a dense mat of plants and runners up to 8 feet long by mid-July. Both are being tested at Tifton, also at Ona, Fla., and Stillwater, Okla., and under irrigation conditions at Brawley, Calif.

A moderately coarse strain from South Rhodesia had completely filled the plot at Tifton with a 20- to 24-inch stand of grass within 15 weeks after being set out at an 8-foot spacing. It will be studied to learn whether it has any advantages over kudzu or other forages for pasturage, hay, or for the control of soil erosion.

A fine-stemmed blue-green strain of Bermuda from Tanganyika, not quite as vigorous as the above, will be studied for useful qualities such as heat and drought tolerance and disease resistance. Some less-vigorous strains will be increased and tested under grazing to see whether they are high in quality, a factor that could offset lack of vigor.

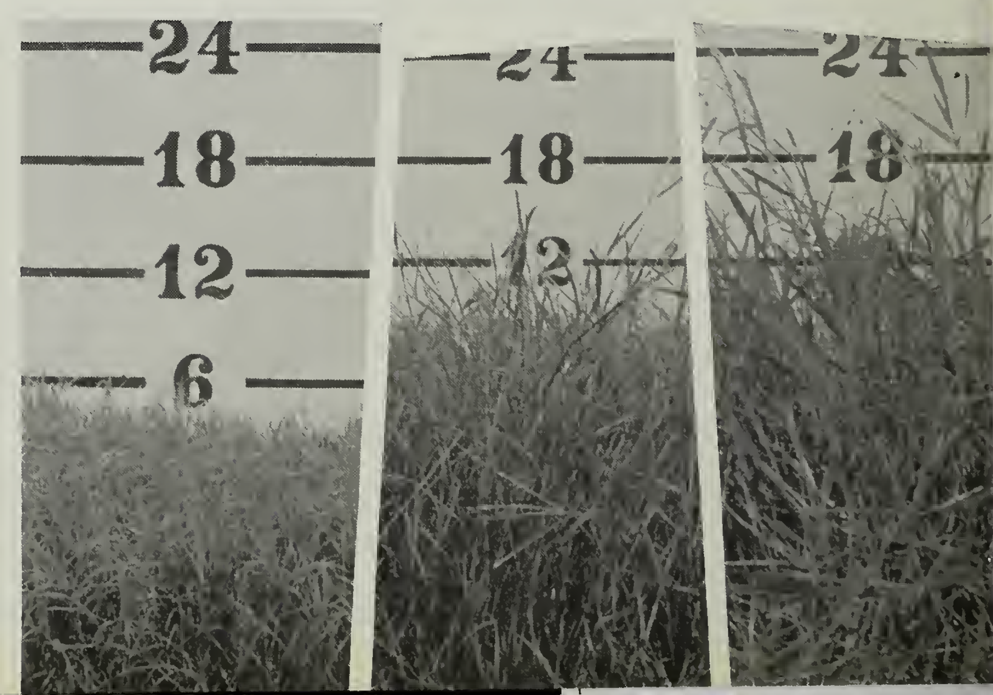
One of the most intriguing of the introductions is a fine-stemmed yet vigorous strain from the Zambesi Falls region of Tanganyika. It starts new plants not only from the tips of long stolons (runners) that spread over the ground surface but also from rhizomes that spread underground. Rhizomes are better insulated against winter injury than surface runners. Perhaps this grass will extend the climatic range of Bermudas somewhat north of the present limits. It will be tried out in colder locations if the Tifton studies warrant the study.

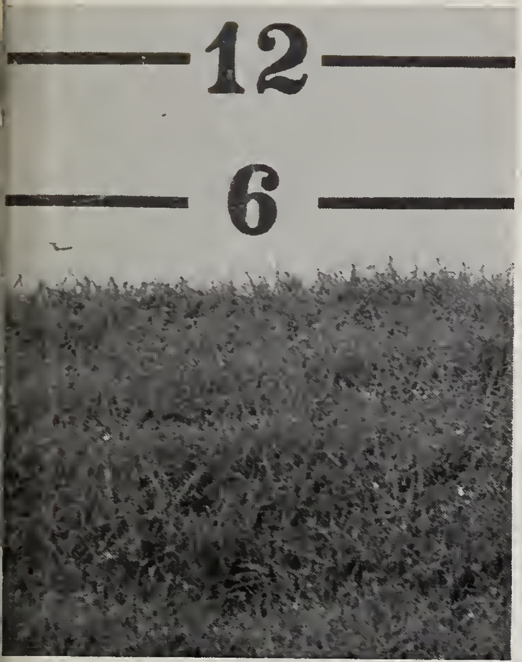
Lawn grass also collected

The agronomists also are watching 2 or 3 low-growing, fine-stemmed lawn-type Bermudagrasses from the Union of South Africa.

It will take a decade to observe, multiply, and graze-test these new plants in comparison with our present forages and to evaluate their breeding potential. One real find would justify the effort it took to collect and test these grasses. ☆

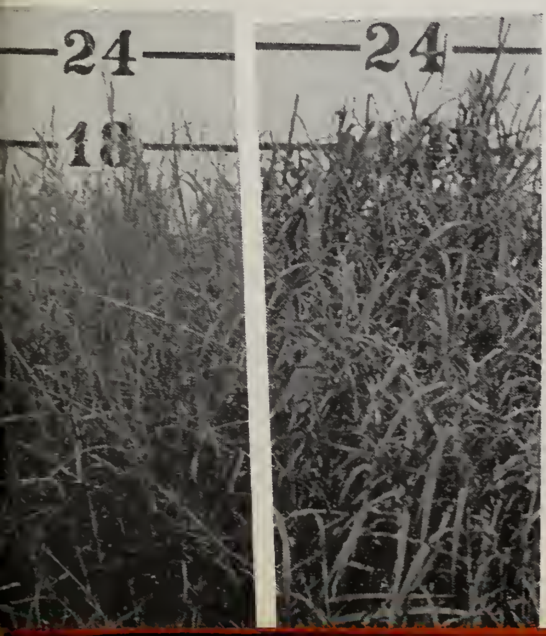
RANDOM SPECIMENS in these test plots suggest the wide variation in quality, yield, and drought and disease tolerance we might expect to find among 50 African Bermudagrasses.





SLOW-GROWING grass from Union of South Africa makes fine turf with little mowing.

SOUTH-RHODESIAN Bermudagrass rivals kudzu in growth, spreads far by long stolons.



Insecticide Residues in Soil— HOW MUCH? WHAT KIND?

■ Ways of determining residues of insecticides in soils are being sought by USDA researchers at the ARS laboratory at Moorestown, N. J. Entomologists are experimenting with bioassay methods to determine the *amounts* of residues. Chemists are trying to *differentiate* chlorinated hydrocarbon insecticides by chromatography.

Information on the quantity and specific nature of the chemicals would help plant-quarantine inspectors to determine the treatment required before nursery stocks move across quarantine lines.

Scientists want to be able to tell nurserymen whether re-treatment is necessary to kill insects, and if so, exactly how much insecticide is needed. They try to keep the insecticides to an effective minimum—low enough to avoid damaging the plant or causing excessive residues in agricultural products for human and animal consumption. ☆

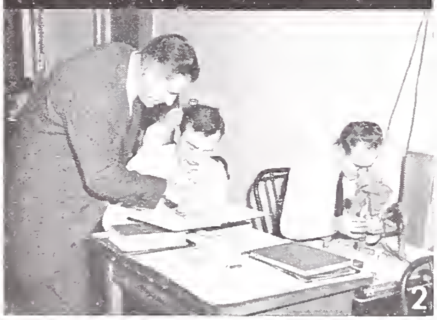
BIOASSAY method calls for use of *Drosophila* (vinegar flies) to determine amount of residues in soil. Researchers anesthetize insects, transfer 25 flies to each dish, containing soil samples with different insecticide combinations. Dishes are checked periodically for 4 days. Counts are taken and number of dead flies recorded so standard toxicity curve may be developed relating fly mortality rate to amount of insecticide in soil. When most widely used insecticides are tested individually, combinations of insecticides will be charted the same way.

CHROMATOGRAPHY (in this case, filtering extract through glass column containing adsorbent; see AGR. RES., April 1956, p. 8) is used in attempt to differentiate chlorinated hydrocarbons. First, chemists shake soil samples (pictured in bag) in mixer. Insecticides are extracted, placed in flasks. Extract colors vary according to soil types (two different samples are pictured here over the containers). Then, experimental work begins on methods of separating compounds. Pump (pictured at left) helps filter extract through column.

THE MAKING OF A PLANT-QUARANTINE INSPECTOR

New trainees get 6 months of formal preparation for their job partly in classroom and laboratory, partly by experience

FIRST, CLASSROOM TRAINING



1. Class at Plant Quarantine Training Center, 641 Washington St., New York, is led by Ira A. Lane, director of school.

2. Microscopes often are used to identify pests. Students work in pairs. They are alerted especially as to certain pests.

A NEW GENERATION of plant-quarantine inspectors—that sharp-eyed corps of scientists who protect our farms from foreign plant pests—is being groomed at a unique school operated by USDA. The school is called the Plant Quarantine Training Center. It is close to the waterfront in lower Manhattan, New York.

The Center's goal is to equip men to keep plant pests—insects, nematodes, snails, mites, and disease organisms—away from our shores. Developing such men is complicated.

The course lasts 6 months, and only men who have had basic college training in biological sciences are eligible to enroll. Three months are spent at lectures and other classroom activities. Three more months on rotated assignments gives trainees a chance to practice inspection work, under the direction of instructors, at places in and around New York City.

Basic subjects are covered

In class, the trainee learns the laws affecting importation and inspection. He takes intensive courses in entomology, botany, plant pathology, and nematology as they relate to plant-quarantine enforcement. Foreign pests likely to arrive with imports of plant materials are given special emphasis. (In addition to the basic course, incidentally, there are special training and refresher courses designed to better acquaint plant-quarantine personnel with the many technical aspects of their jobs.)

3. Carl Breckner has his first supervised experience by inspecting cargo and baggage as they are unloaded from a liner at the docks in Hoboken.

On rotated assignment, the trainee is sent out to actual inspection sites. This includes docks, for example, where the student learns to apply knowledge of pest habits in examining newly arrived ships. He carefully examines cargoes, stores, and personnel quarters. On the piers, he learns how to cooperate with Customs inspectors in searching passenger baggage for pest carriers.

A trainee's education is carried on at New York's International Airport, Idlewild. He learns to adapt maritime methods to airborne traffic. At the Hoboken Inspection Station, he learns various ways to inspect and treat propagating material. He is shown advanced treatment methods recently developed through research.

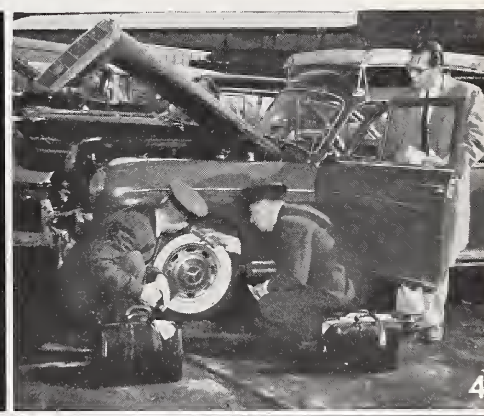
The Center operates year round. A new class begins every 3 months. When it finishes class work and goes on rotated assignment, another group is admitted. The course is accredited by USDA's Graduate School.

School serves global need

This school has evolved since the end of World War II. Previously, training was conducted on a semi-formal basis at individual plant-quarantine stations. Expansion of world travel and commerce after the war increased threats of foreign pests. The increased speed of overseas air traffic complicated the problem. For these reasons, a thoroughly trained inspection staff was needed.

Group training started right after the war. By 1949, a 7-week course in entomology was begun. More material was added, and in 1956, the full 6-month course got underway. ☆

THEN, SUPERVISED PRACTICE



4. Plant inspector A. M. Trafford shows that some cars come heavily caked with soil that may harbor pests such as nematodes. Cars must be inspected underneath and heavy soil deposits cleaned off on the spot.

5. Customs inspector V. Amalfitano (center) has found some onions and fruit in baggage of a passenger debarking from a liner at Hoboken. These are being confiscated by ARS trainee-inspector Charles Catlett.

6. Trainee gets some pointers as plant inspector (right) examines a cargo of endives just received from Belgium on the liner. Inspection is taking place at the Hoboken docks.

When Do FAMILIES Replace EQUIPMENT?

■ FAMILIES IN THIS COUNTRY buying new electric refrigerators and electric and gas ranges use them for an average of 15 years before replacing them. Electric washing machines, both the automatic and the wringer and spin-dryer types, are being replaced after 9 years, if they were new when acquired. All these items, when acquired secondhand, are being kept in service about half as long as new items.

These estimates of service-life expectancy were calculated by USDA home economist Jean L. Pennock and statistician Carol M. Jaeger, of the ARS Institute of Home Economics. The scientists applied actuarial techniques to data that were collected by the Bureau of the Census as a supplement to the January 1957 Current Population Survey.

Actuarial methods—used by life-insurance statisticians to compute life expectancy of human beings—have been used for some time to compute the service-life expectancy of industrial items. But until now the method has not been applied to consumer goods. Householders and budget counselors need such estimates for planning family budgets and estimating family assests. Manufacturers and distributors will find the life-expectancy data useful in anticipating consumer demand.

In the survey, families who owned electric refrigerators, gas or electric ranges, or electric washing machines were asked when their equipment had been aquired and whether it was new or used when they got it. The same questions were asked concerning equipment discarded during 1956. From the answers, separate tables of service-life expectancy under one owner were constructed for items bought new and those bought used.

Estimates obtained by this method reflect current practice on replacing equipment. Replacement rates will change as changes occur in family size and ways of life, income, cost and availability of service, durability of items in use, and attractiveness of new equipment.

The study showed that rural families tend to use their electric refrigerators and manual washing machines longer than urban families. The investigators believe this is largely due to lower income levels in rural areas. They also think that farm families have tended to keep their wringer and spin-dryer washers in use, rather than replace them with the newly introduced automatics, because the water supply on many farms is not large enough for the automatic washing machine.

On the other hand, the findings show both gas and electric ranges have shorter life expectancies in rural than in urban areas. This the investigators attribute to harder use by rural households. Rural families are larger and more food is prepared at home, especially baked goods. The higher humidity in many farm kitchens, from using the range to heat water for the household, may cause greater rusting. ☆

How to Prevent BLUEBERRY CLUMPING

Agitation during cooling will keep fruit from massing

■ CANNED BLUEBERRIES may vary from an attractive, free-flowing product to one that is clumped into a firm mass. Badly clumped berries are less desirable—they are harder to use and separation often results in torn skins and an unattractive pulp.

USDA studies show clumping can be prevented by agitation during the water-cooling that follows heat-processing of syrup-packed berries. Measures that help to a minor extent include using varieties with less clumping tendency and avoiding overcooking (which may rupture berries).

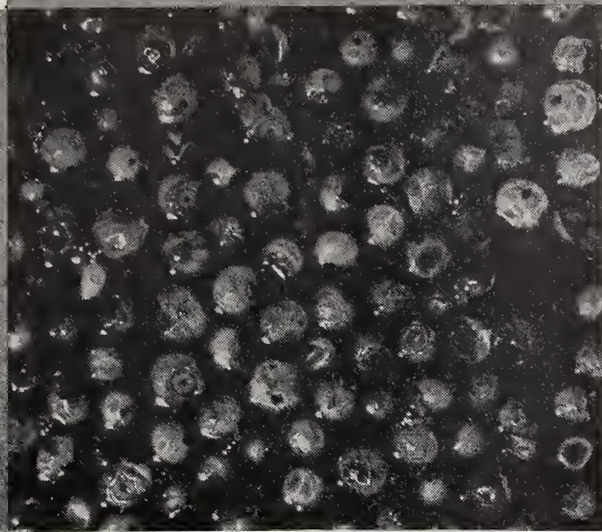
Eleven blueberry varieties were experimentally processed and canned at the Western Utilization Research and Development Division. Albany, Calif. The study was done by ARS bacteriologist M. J. Powers, histologist R. M. Reeve, and chemists L. R. Leinbach and J. E. Brekke.

Process, varieties studied

Researchers varied the heating and cooling. Agitation of some of the cans simulated the action of continuous fruit cookers and coolers that pass cans along a circular path.

Nearly all the tested varieties of blueberries clumped. But the Jersey,

WHAT THE CONSUMERS SAW . . .



BADLY CLUMPED blueberries on extreme left are typical of those generally seen after berries have been cooled without agitation Clumping has been eliminated in attractive blueberries on right by agitation of cans during water-cooling process. Undesirable clumping—and jelly formation—is also caused by overprocessing.

Stanley, Cabot, and Pemberton varieties clumped less than the others. Agitating cans of syrup-packed blueberries during water-cooling to 100° F. greatly reduced or eliminated clumping. Cans cooled without agitation often showed severe clumping, and shaking the cans after cooling didn't reduce it at all. In a transportation test, shipping blueberries 4,000 miles by railroad freight didn't affect clumping much.

Heat, agitation are factors

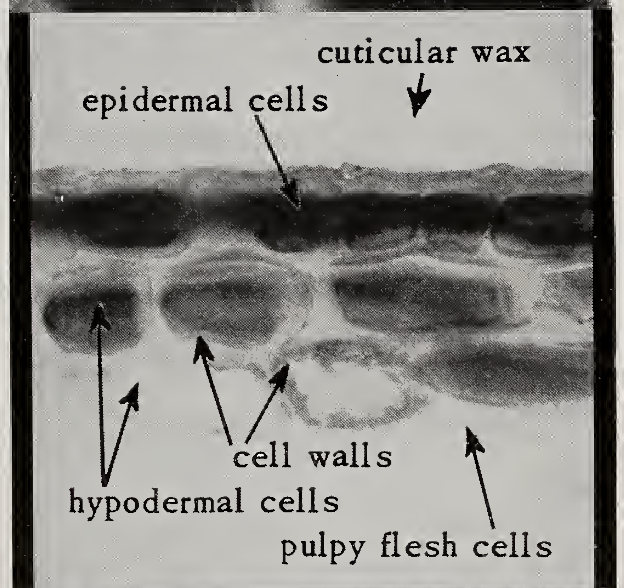
Berries that tend to clump moderately will clump more severely as the processing temperature is raised. Although blueberries may be firmly clumped, the water or syrup surrounding them will remain fluid.

Cooking and cooling without agitation produced some clumping regardless of variety. There was no clumping when these berries were reheated to 190° F. and agitated during cooling. Other samples—processed by still-cooking and rotary agitation during cooling—showed no clumping. Those clumped were reprocessed by still-cooking and still-cooling.

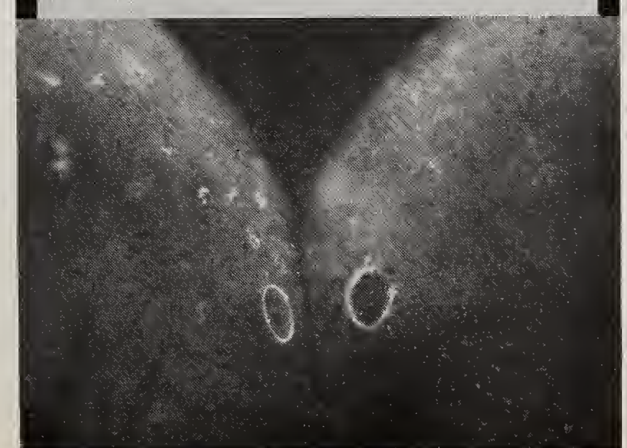
Evidence shows cuticular wax—or cutin—is chiefly responsible for clumping of unbroken berries. Agitating them while they're cooling apparently interferes with the binding together of berries by cutin. ☆

WHAT THE SCIENTISTS SAW . . .

WHITE BLOOM of soft, outer wax layer is shown on fresh, whole berry on right. Bloom wax of berry at left was removed by 2-minute chloroform rinse. This wax layer is mostly responsible for the undesirable clumping.



SKIN AREA of blueberry is shown in photomicrograph at left. Cuticular wax is clearly visible as light-colored area that covers epidermal, hypodermal cells—lying above flesh cells.



PARTLY SEPARATED clumped berries show points of fusion of surface wax. Circular ridges are formed at points when berries are pulled apart. Skin tears easily, berries aren't as pretty.

LES · FRUITS & VEGETABLES · FRUITS

ROUNDABOUT ROUTE TO PLANTS

■ Scientists foresee the day when man may use plants themselves to put chemicals in hard-to-reach places where our crops need them.

This needn't tax the imagination. Researchers at USDA's Agricultural Research Center, Beltsville. Md., have already found three organic acids that not only regulate growth in a treated plant but also transfer through the soil to nearby plants and regulate their pattern of growth.

ARS plant physiologists P. J. Linder, J. C. Craig, Jr., F. E. Cooper, and J. W. Mitchell recently found that two organic acids, daubed on a plant stem, will move throughout the plant, dwarf it, and move on into the soil to dwarf nearby plants.

The chemicals are 2,3,6-trichlorobenzoic acid and 2,3,5,6-tetrachlorobenzoic acid. One other chemical, somewhat different than these but having the same growth influence and capacity for movement, was found in 1953 by Mitchell and W. H. Preston, Jr. (Agr. Res., January 1954, p. 3). Called MOPA for short, it is alpha-methoxyphenylacetic acid.

We've known for some time that several chlorinated benzoic acids make plants modify growth. Studying the effect of these chemicals on bean flowering, plant physiologist P. C. Marth suspected that eight of them might pass through roots into the soil, as does MOPA. Those 8 were tested and only the above-named 2 showed in limited study that they are transferred from root to root.

The 2,3,6-trichlorobenzoic acid showed such strong transferability that it was tested on various plants and under various conditions. The experiments were arranged so vapor drift from the treated plants would not be a factor in the studies.

Bean seedlings, treated and stunted by a daub of that chemical on the stem, did actually discharge some chemical from their roots. Enough of it went into the water or soil the plants grew in to stunt untreated bean seedlings grown later in the same water or soil. Characteristic stunting occurred also in the second successive batch of beans planted in the same soil 17 days after the first ones had been treated with the chemical.

The acid stunted plants of several genera—beans, sunflower, barley, corn—and passed by root and soil between the several genera of plants.

The scientists hope to learn just what physical properties, atomic constituents, or molecular arrangements these three acids have in common to cause their effect on plants. Knowledge of that might help us to find other chemicals or build them with desired growth or antibiotic effects, systemic movement, and interplant transfer. Such combinations might some day enable us to give plant roots a protective shield against soil-borne diseases, nematodes, or other root pests, or to favor beneficial soil organisms. And we might treat hard-to-reach plants through other plants—for example, sheltered legume seedlings through their nurse crops. ☆

DAIRY · DAIRY · DAIRY · DAIRY · DAIRY · D

MAKING GOOD SILAGE IN HORIZONTAL SILOS

■ The horizontal silo—low-cost version of the familiar tower structure in many barnyards—hasn't quite lived up to the hopes of its innovators. But this may change as a result of recent discoveries through USDA research.

The problem has been excessive spoilage and low quality of silage put up in trenches, bunkers, and horizontal stacks. Too much surface was exposed to the air and the silage often was not adequately packed. This exposure causes extensive spoilage of surface silage through action of aerobic organisms. Leaching of soluble nutrients by rain and snow is another considerable loss.

ARS dairy husbandman C. H. Gordon and agricultural engineer J. R. McCalmont have now found that covering horizontal silos with modern plastic sheetings can seal off the air effectively and keep down spoilage. With best materials and handling techniques, Gordon and McCalmont put up silages that lost as little in dry matter as farmers are experiencing by good packing and sealing techniques with upright silos. Other studies show losses of 10 to 15 percent of original dry matter in upright silos. For the horizontal tests as a whole, total losses ranged from 10½ to 31 percent. Ten and a half percent is much less than most farmers lose in trenches, bunkers, and stacks.

The poorest results were with 54-inch-wide sheets of 8-mil-thick vinyl plastic joined at the seams with pressure-sensitive tape and weighted only around the edges of the bunker with pipes and sawdust. This sheeting was

tight at first, but ultimately puckered at the seams, owing to different elasticities of the vinyl and the tape. That allowed small air leaks to open up, causing a total loss of 31 percent of original matter. About 12 percent was lost as spoilage alone, the remainder as "hidden losses" (fermentation and seepage of the juices).

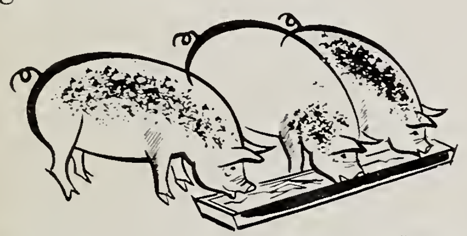
Only 5 percent spoilage occurred where a 4-mil polyethylene sheet with heat-sealed seams was used on a shallow stack of chopped, untreated orchardgrass. This plastic cover was weighted down with soil at only the edges and center of the stack.

Least spoilage in bunkers was in orchardgrass covered with neoprene-coated nylon. Eight pounds of sodium metabisulfite was added per ton of grass. Covers were weighted with sawdust all over and with railroad ties at the edges. Silage was good all the way to the surface, except for a very small spoilage next to the wall. From 87 to 89½ percent of the dry matter ensiled was actually fed to cattle.

An exceedingly low amount of spoilage occurred in corn silage in a shallow stack with gently sloping sides. Total loss was not measured, however, since the silage was self-fed to cattle. This corn was covered with several pieces of used vinyl and weighted with sawdust. Easy slopes were an important factor in success with this silage. The film could be continuously weighted on those gradual slopes. And the silage could be packed well by a tractor driven over it repeatedly in all directions.

Getting and maintaining a firm weight over the entire silage cover was one of the biggest factors in eliminating costly spoilage of the top silage.

Silage saved by the best covering procedures is worth about three times what a tight cover costs. ☆



needed: better group dosing

■ PRESENT METHODS of group-dosing pigs with piperazines for worms may not be effective under field conditions, according to USDA research.

The commonly accepted dosage of 50 milligrams of piperazine per pound of body weight is effective against ascarids (large roundworms) and nodular worms when pigs are *individually* treated. Studies at the Agricultural Research Center, Beltsville, Md., showed this dosage wasn't as satisfactory when 3 or 4 pigs were treated together. A dosage larger than 50 mg. per pound of body weight may be necessary when the drug is given in limited amounts of feed or water to groups of pigs. (Researchers elsewhere obtained excellent results using over 100 mg. per pound.)

Piperazine compounds aren't new, but their use in controlling livestock and human worm infections is new, effective, and widely practiced. Piperazines are especially good for this application because they (1) get rid of nodular worms and mature and immature ascarids, (2) are safe for animals, and (3) leave no residual deposits in edible tissue. Biggest problem is assuring adequate dosage under field conditions.

Piperazines are conveniently given to pigs in feed or drinking water—depending on the compound used (some aren't water soluble), the available facilities, and personal preference. Drugs should be consumed fairly rapidly—within 24 hours—to get best results at lowest cost. To help achieve this, animals are deprived of feed and water 12 to 18 hours before treatment. Measured doses of piperazine are then put in smaller amounts of feed and water than the animals normally consume in 1 day.

Animals thus treated in a group don't all respond to treatment the same way. The more vigorous and maybe less heavily parasitized animals may obtain most of the medicated feed. Palatability differences will also cause animals to eat and drink varying amounts of medicated feed and water. And animals differ greatly in how much they drink from season to season, even day to day.

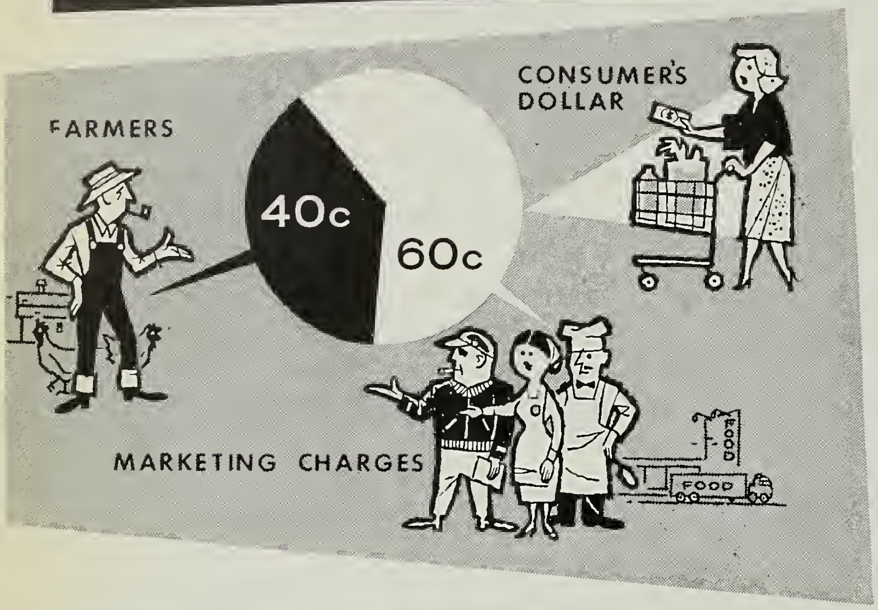
Failure of treatments due to differences in palatability may necessitate the development of flavoring or masking agents. Or other salts with a better flavor might be found.

In limited tests, piperazine citrate seemed to be one of the most satisfactory compounds tested. Given in drinking water, it was palatable to all animals and was effective against both ascarids and nodular worms. There were great variations, however, in the palatability of the compounds and the efficiency of treatments.

Speed of consumption is related to palatability and efficiency of treatments. The faster the animals consumed medicated feed or water, the more efficient was the treatment. For example, piperazine sulfate removed 100 percent of the large roundworms in one trial when all the medicated water was consumed in 7 hours. But efficiency was substantially lower when only 85 percent of the water was consumed in 24 hours.

ARS veterinarian F. D. Enzie and parasitologists E. H. Wilkens and M. L. Colglazier see a critical need for studies of several piperazine compounds on groups of 10 or more animals, to determine best dosages under practical farm conditions. ☆

THE WIDENING FARM-RETAIL PRICE SPREAD



Producers are receiving about the same for food, but marketing charges are rising

■ THE PRICE SPREAD between farmers and consumers is increasing. Farmers received an average of 40 cents of every retail dollar consumers spent for food last year. This share is expected to be less during the present year.

What we call the farm-retail spread is the difference between the retail price of a product and its farm value (payment to farmers). This spread is also known as the product's marketing margin or marketing charge.

Further rise probable in marketing charges

USDA studies by Agricultural Marketing Service economists indicate that there was a rise in the annual average marketing charges in 1957, and there may be another rise this year. But prices farmers receive for food products will probably remain about the same.

Marketing charges represent payment for services in moving agricultural products from farms to consumers, including local assembly of products, processing, storage, transportation, wholesaling, and retailing. Transportation comprises 10 to 15 percent of the marketing costs.

The farm-retail spread is specifically affected by depreciation charges, rent, taxes, advertising, fuel, power, other utilities, supplies, containers, and profits. But labor is the major cost factor. Wage rates are expected to continue upward. Prices of equipment, supplies, and other items that marketing firms buy may average higher this year. Marketing firms may be able to offset prospective increases in prices and wages to some extent by possible improvements in efficiency of operations.

AMS calculates the farm-retail spread for a Market Basket of 60 farm foods. This includes meats, dairy products, poultry and eggs, bakery and cereal foods, fruits and vegetables, fats and oils, and miscellaneous items such as sugar, corn sirup, and grape jelly. The retail costs of these foods are based on Bureau of Labor Statistics data. Prices are collected for the Bureau of Labor Statistics by agents in 46 cities around the 15th of each month.

Market Basket based on farm, retail prices

Payments received by farmers for products (allowing for spoilage, shrinkage) are subtracted from these retail prices to calculate the farm-retail spread for the Market Basket. In the 1940's, this spread increased less than farm or retail prices. But since 1950, there has been a continuing increase in the spread. These changes are mostly independent of supply and demand factors affecting farm and retail prices of products the farmers sell.

Over long periods, farm-retail spreads for Market Basket items tend to parallel general trends in marketing costs. The spread also reflects some effects of changes in services, such as washing and prepackaging fresh products. Short-run fluctuations are caused mainly by seasonal movements of prices owing to the effect of production cycles.

Though farmers averaged 40 cents out of every food dollar consumers spent in 1957, the amount differed for individual foods. Generally, the more highly processed the product, the smaller the farmer's share. For example, farm receipts for wheat in flour averaged 38 percent of retail prices, but in bread, averaged 15 percent.

Foods derived from animals and animal products tend to have a higher farmer's share than those derived directly from crops because farm inputs are relatively greater for animal products than for crops. Farmers averaged 67 percent on eggs, 69 percent on butter, and 60 percent on choice beef—but 20 percent on processed fruits and vegetables, and 31 percent on fresh vegetables.

Trends noted in production and distribution

Still other trends have been noted regarding production and distribution of Market Basket items. Quantity of farm products to be marketed may be as large or larger than last year's big volume. Supermarkets are likely to sell a larger share of retail goods in years ahead. Wholesale food trade continues to grow, although direct buying by retailers from manufacturers has increased. Integration in the food industry, through ownership or contract arrangements, has also grown materially. ☆

Nematode resistance found

Sorting through approximately 3,000 selections and varieties of USDA's world soybean collection has turned up 4 genotypes that show resistance to soybean cyst nematode.

Field tests were conducted last summer in cooperation with the North Carolina Agricultural Experiment Station. These 4 genotypes showed their resistance to the cyst nematode by the pest's limited amount of reproduction and population buildup. ARS researchers found also that second-stage larvae that invaded the roots of the resistant lines failed to develop to maturity.

These experiments mark some of the first steps in development of nematode-resistant soybean varieties from germ plasm that's already available to us, the scientists point out.

Although heavy infestations of this threadlike eelworm can destroy soybean plantings in some areas, the cyst nematode does not pose an immediate nationwide threat, ARS plant disease specialists say. If and when infestations become more widespread, however, the researchers hope to have

several high-yielding, nematode-resistant varieties available for distribution to the growers in nematode areas.

In past trials, scientists have found it difficult to evaluate varieties for nematode resistance because of the uneven distribution of nematode population in the planting area. This handicap was overcome by planting an easily identified susceptible line beside each test variety. The susceptible plants serve as checks in determining the presence of nematodes and extent of damage they cause.

Double-row tests show promise in evaluating other crops' resistance to nematodes, other soil-borne diseases.

Better processed cherries

Firmness and quality of canned and frozen red cherries was improved in tests by horticulturists C. L. Bedford and W. F. Robertson, Michigan Agricultural Experiment Station, working under contract with ARS.

They increased the drained weights of canned cherries by air-cooling, soaking in calcium solutions, and canning with dry sugar. Canning the cherries with various added calcium salts, sugar syrup, or pectin had no effect on drained weights. (The Food and Drug Administration hasn't authorized commercial cherry canners to use calcium salts simply because there has been no previous experience with such use. The salts are used, however, in canning potatoes, tomatoes, and several other products.)

Although method of cooking had no effect on firmness of the processed cherries, the longer they were cooled, the firmer they became. Cherries soaked in calcium solutions before processing were firmer than those that were water- or air-cooled.

Adding calcium to the cherries just before processing also increased their firmness—the more the calcium, the firmer the cherries. Canning with sugar or sugar syrup also increased the firmness of the fruit; dry sugar was more effective.

Taste-panel evaluations on pies made from cherries treated in various ways indicated that those treated with sugar or sugar syrup tasted best.

The industry has been plagued with soft red cherries that wouldn't firm up during soaking. (Soft cherries are hard to pit without tearing or crushing.) Variations in firmness can't be attributed to any one area or orchard because cherries at any location may be firm one year and soft the next.

Growing conditions—water, temperature, humidity, nitrogen fertilization—have a lot to do with cherry firmness. Most of these factors can't be controlled in commercial practice. But proper handling, good storage and processing techniques, and use of effective additives can all help.

More wild yams collected

Recent collection by USDA of wild *Dioscorea* yams—the plants from which the antiarthritic drug cortisone is made—may assist in establishing this as a domestic drug crop.

USDA has been growing *Dioscoreas* from earlier collections in Mexico and Central America to test adaptability and develop suitable methods of culture. At the time of introduction, some of the plants being test-grown were much richer than average wild roots in the desirable kinds of sapogenins. They're the substances from which cortisone, sex hormones, and other steroid-type drugs are made.

After growing in our trial plots, however, all of these previously introduced *Dioscoreas* have assayed disappointingly low in sapogenin. The plants will, of course, be grown longer in the hope that greater maturity of plant or discovery of a better environment or better production method will lead to a higher assay.

The recent collection from Mexico, Costa Rica, and Guatemala includes several above-average producers of diosgenin—the principal form of sapogenin found in the most common wild *Dioscorea* species. There are

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also other species containing the higher quality forms of sapogenin known as gentrogenin and corellogenin. Some of the plants have short runners and upstanding leaves that seem to get enough sunlight and produce well without trellises.

All these desirable characters will be studied by our plant breeders. It will obviously take years to develop a sound *Dioscorea* crop.

Two new watermelons

Plant breeders at USDA's Southeastern Vegetable Breeding Laboratory, Charleston, S. C., have unveiled two improved watermelon varieties that should catch the eye of growers, shippers, retailers, and consumers.

The newcomers—Blackstone and Garrisonian—are heavy yielding, anthracnose resistant, and relatively free of hollow and white heart. Both have hard rinds, which make them good handlers. Best of all, they are sweet, flavorful, crisp, and tender.

Although the melons are quite different in type, each promises to satisfy a particular need in the watermelon industry. Blackstone is expected to fill, in part, the long-standing need for a large, round, dark-green, disease-resistant watermelon in the 28- to 34-pound class to replace the present cannonball type. Because of susceptibility to many diseases, cannonball varieties have rapidly lost popularity with growers.

The Garrisonian is tailored for the consumer who wants extra large and fancy melons weighing 40 to 60 pounds. Its forerunner, Garrison, has been a standard of supreme eating quality in the South for many years but has not been shipped extensively because of its tender rind.

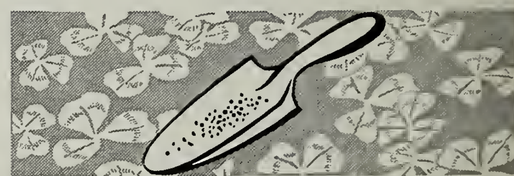
Blackstone was developed and introduced from Charleston. Garrisonian was developed there and released in cooperation with the South Carolina Agricultural Experiment Station.

Seeds of both varieties are available through commercial seedsmen. USDA has no seed for distribution.

Virus cuts Ladino seeds

Alfalfa mosaic and bean yellow mosaic—virus infections that often slice Ladino clover *forage* yields one-fourth to one-half—produce equally devastating results in flowering and seed production of this crop (Agr. Res., April 1956, p. 7).

Greenhouse and field-plot experiments were conducted at USDA's Agricultural Research Center, Belts-



ville, Md. ARS plant pathologist K. W. Kreitlow and agronomist O. J. Hunt found that these two diseases reduce flowering by 20 to 44 percent, seed production by 29 to 54 percent.

Scientists also studied effect of virus on seed germination and transmission of the viruses through seeds. Tests showed only slight germination difference between seeds from virus-infected and healthy plants. It was found that transmission of these two viruses occurs rarely, if at all, through Ladino clover seeds.

These findings on seed yield have stimulated search for resistant Ladinos. One method of testing present varieties for resistance is to inoculate Ladino seedlings with the alfalfa and bean yellow mosaic viruses. In that way scientists can determine susceptibility in only 4 to 6 weeks from the time the seed is planted, thereby speeding selection and development of resistant material.

Until resistant varieties are available, growers should avoid planting Ladino clover near alfalfa, red clover, and other legumes. Viruses are frequently spread from field to field by aphids and other insect carriers.

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